LOAD BANK
TECHNICAL MANUAL

Customer: XXXXX

Work Order: XXXXX-XX-XX

Model: Merlin 150KW-300KW

March 2011

The information herein is the property of Simplex, Inc. and/or its subsidiaries.
Without written permission, any copying, transmitting to others, and other use
except that for which it is loaned, is prohibited.
(File: Merlin-150-300c.indd)

Contents

DESCRIPTION 2

PRIMARY INSPECTION 4

LOAD BANK LOCATION 4

OPERATION 5
- Shutdown 6

COOLING FAILURE SUBSYSTEM 6

LOAD OVER VOLTAGE DETECTION SUBSYSTEM 7

LOAD ELEMENTS 7

MAINTENANCE 8
- Each Operation 8
- Every 50 Hours or 6 Months 8

TROUBLESHOOTING 8
- Cooling Fan Motor Will Not Operate 8
- Load Over Voltage Indicated 9
- Cooling Failure Indicated 9
- Test Meters Do Not Operate Properly 9
- Some Load Steps Cannot Be Energized 9

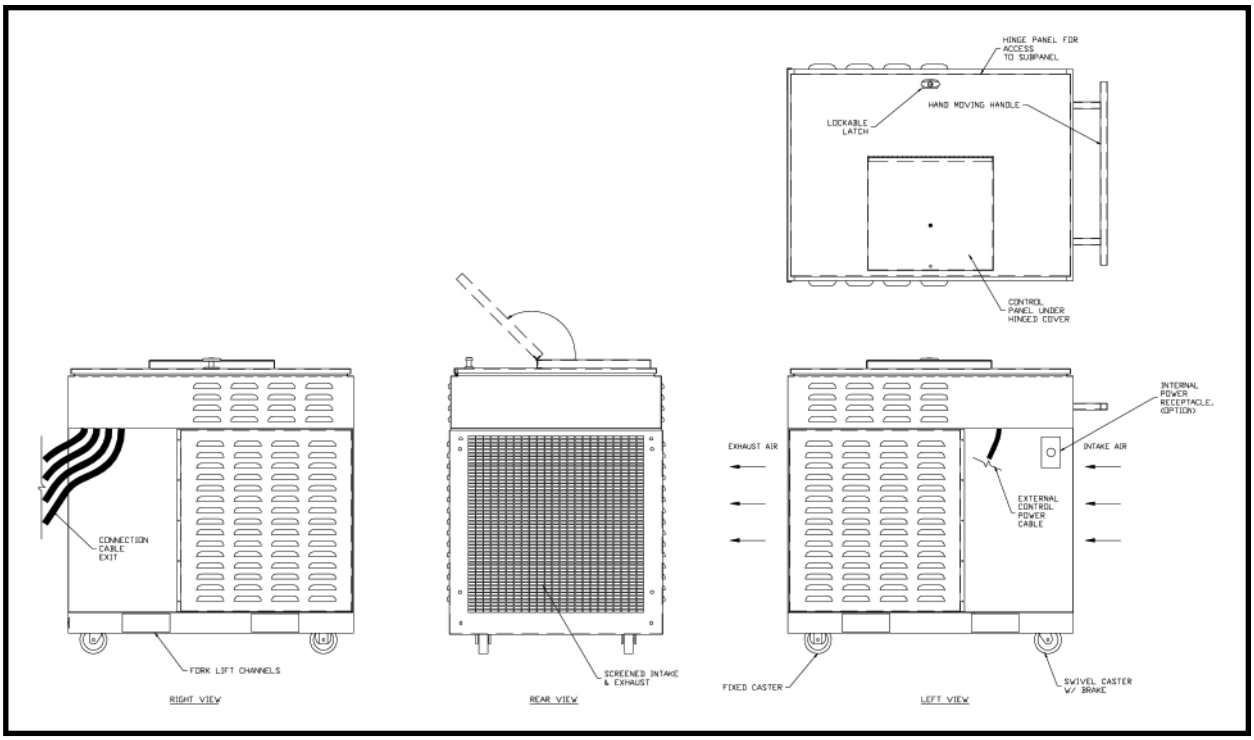
DRAWINGS AND PARTS LIST 9

APPENDIX A - ABBREVIATIONS USED IN THIS MANUAL 10

APPENDIX B - CALCULATIONS & FORMULAS 11

APPENDIX C - TORQUE VALUES 14

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com



Part of Typical Pictorial Drawing

DESCRIPTION

Simplex Load Banks are precision test instruments specifically designed to apply a discrete, selectable resistive electrical load to a power source while measuring the response of the generator to the applied load. They also provide a means for routine maintenance exercise to assure long term reliability and readiness of the standby generator. Exercise Load Banks eliminate the detrimental effects of unloaded operation of diesel engine generators.

This fully self-contained Load Bank includes test instrumentation, cooling system, rugged load elements, load-application control devices and automatic system protection devices. Operating controls are located on a Local Control Panel.

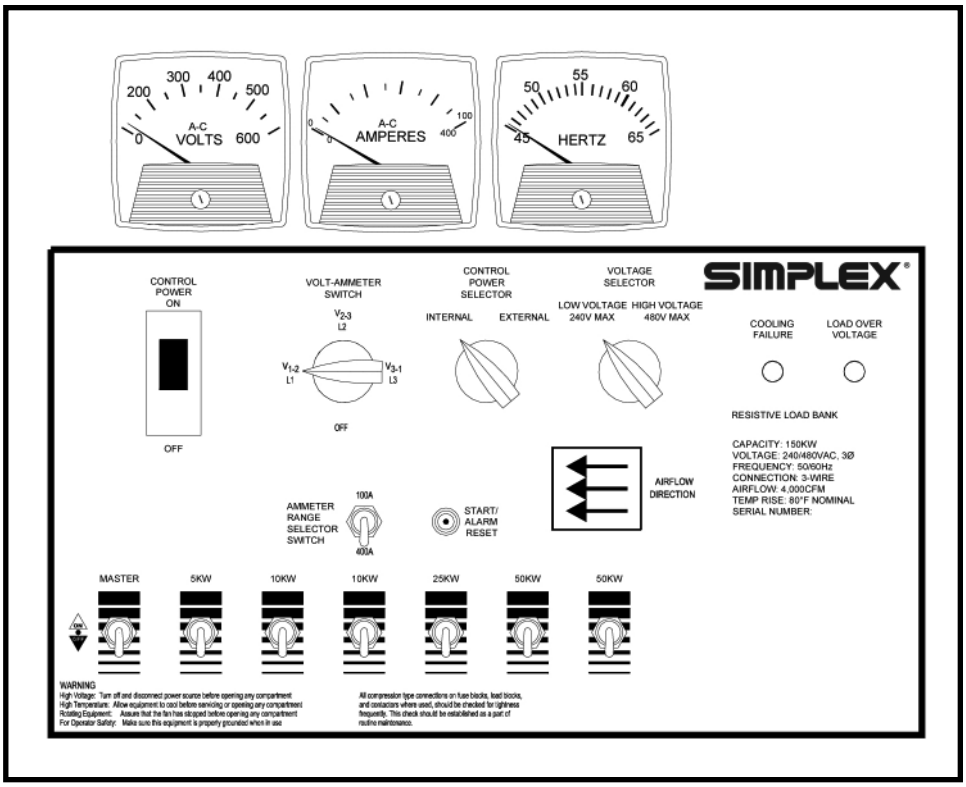
See the Load Bank Specifications Sheet in the front of this manual for the specifications of your Load Bank.

The illustrations in this manual are examples only and may differ from your Load Bank.

⚠ WARNING ⚠

Always remove all power from the load bus and all fan/control power before servicing the Load Bank. Never operate or service a Load Bank that is not properly connected to an earthground.

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com



Part of Typical Local Control Detail Drawing

The Local Control Panel is comprised of the following components:

1. Voltmeter, Ammeter, and Frequency Meter
2. Control Power, Volt-Ammeter, Ammeter Range Selector, Control Power Selector, and Voltage Selector switches
3. Cooling Failure and Load Over Voltage lamps
4. Ammeter Range Selector Switch
5. Alarm Reset pushbutton
6. Master Load and load step switches

The resistive load elements in this Load Bank are cooled by a horizontal forced air system. The load system is connected to the test source via the load cables.

This Load Bank is equipped with the following automatic safety systems which de-energize all load steps when any condition is present which could damage the Load Bank or present a safety hazard to the operator:

1. The Cooling Failure Subsystem de-energizes any load applied when cooling of the load elements becomes inadequate due to fan failure, high intake air temperature, or high exhaust temperature.
2. The Load Power Over Voltage Failure System removes all load from the test source in the event the Load voltage selector switch is in the low voltage position (less than 240V), and a high test source voltage (greater than 480V) is applied.

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

PRIMARY INSPECTION

Preventative visual inspections of the shipping crate and Load Bank is advised. Physical or electrical problems due to handling and vibration may occur. Never apply power to a Load Bank before performing this procedure. The following Nine Point/30 Minute Inspection is recommended before installation, as part of the 50 hour / 6 month maintenance schedule and whenever a Load Bank is relocated:

1. If crate shows any signs of damage examine the Load Bank in the corresponding areas for signs of initial problems.
2. Check the entire outside of the cabinet for any visual damage which could cause internal electrical or mechanical problems due to reduced clearance.
3. Operate all hinged panels and doors for smooth and safe operation, try all latches and knobs.
4. Rotate and push all switches through all positions to ensure smooth operation.
5. Check cooling system by inspecting fan motor and blade. Slowly rotate blade by hand and note clearance of blade tip through its rotation near the housing. Observe free rotation of motor shaft.
6. Inspect all relays, timers, and control modules by opening all accessible panels. Make sure all components are secure in their bases and safety bails are in place. Spot check electrical connections for tightness. If any loose connections are found inspect and tighten all remaining connections.

If any problems are observed during Primary Inspection call the Simplex Service Manager at 217-483-1600 (24hrs.)

7. Examine all accessible internal electrical components such as fuses, contactors and transformers. Check lugged wires at these components.
8. Inspect bottom of crate/enclosure for any components that may have jarred loose during shipment such as indicator light lenses, switch knobs, etc.
9. Visually inspect element chamber for foreign objects, broken ceramic insulators, mechanical damage.

LOAD BANK LOCATION

The load elements in this Load Bank are cooled by a horizontal forced air system which discharges through the rear of the cabinet. Location of the Load Bank is of prime importance and should be done by trained personnel. It is one of the most critical factors involved in safe operation. The Load Bank must be positioned and installed according to large airflow requirements. Never point the exhaust at a nearby surface or object which may be adversely affected by high temperature. Never operate the Load Bank in a confined space without regard for adequate intake of air and provision for exit of high temperature exhaust. Consider that the Load Bank and a nearby generator set may have to compete for cooling air. Never bounce hot exhaust air off nearby objects and allow it to recirculate through the cooling system. Never operate the Load Bank in proximity to a sprinkler system.

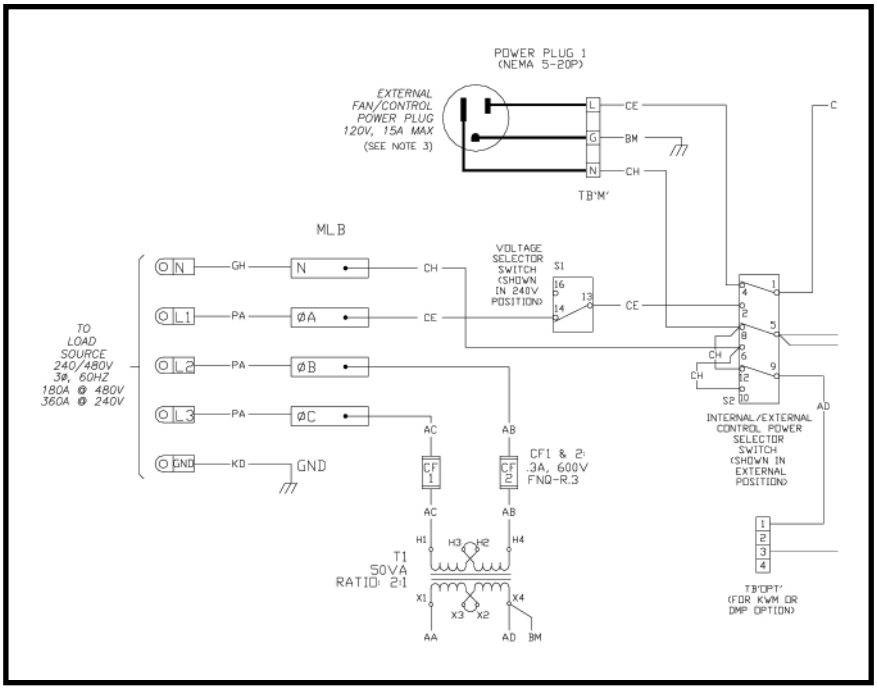
Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

OPERATION

1. Confirm the test source is properly grounded and ground the Load Bank to its own independent ground.
2. Confirm the "Control Power" circuit breaker (FCB) is in the "Off" position.
3. *See Control Section Drawing:*
   a. Using the cables provided, connect the load source to the Load Bank as shown.
   b. If external control power is desired, place the External Fan Control Power Plug into a 120V, 1ø, 60Hz, 15A receptacle.
4. Place the "Control Power Selector" switch and "Voltage Selector" switch in the appropriate positions.
5. Start-up generator set or bring other test source on line.

   If External Control Power is being used, place the "Control Power" circuit breaker to energize the cooling fan before starting the generator to assure proper fan operation (Step 7).
6. Adjust power source voltage and frequency.
7. Place the "Control Power" circuit breaker (FCB) in the "On" position to energize the cooling fan.

   A false "Cooling Failure" lamp indication will be present until the cooling fan creates sufficient airflow to close the Fan Pressure Switch (PS) and the "Alarm Reset" pushbutton is pressed (Step 9).
8. Visually observe correct fan operation and investigate any unusual fan related noises.



Part of Typical Control Section Drawing

9. Check air intake for obstructions and confirm positive air flow.
10. Press the "Alarm Reset" pushbutton.
11. Verify the "Cooling Failure" lamp is extinguished before proceeding.

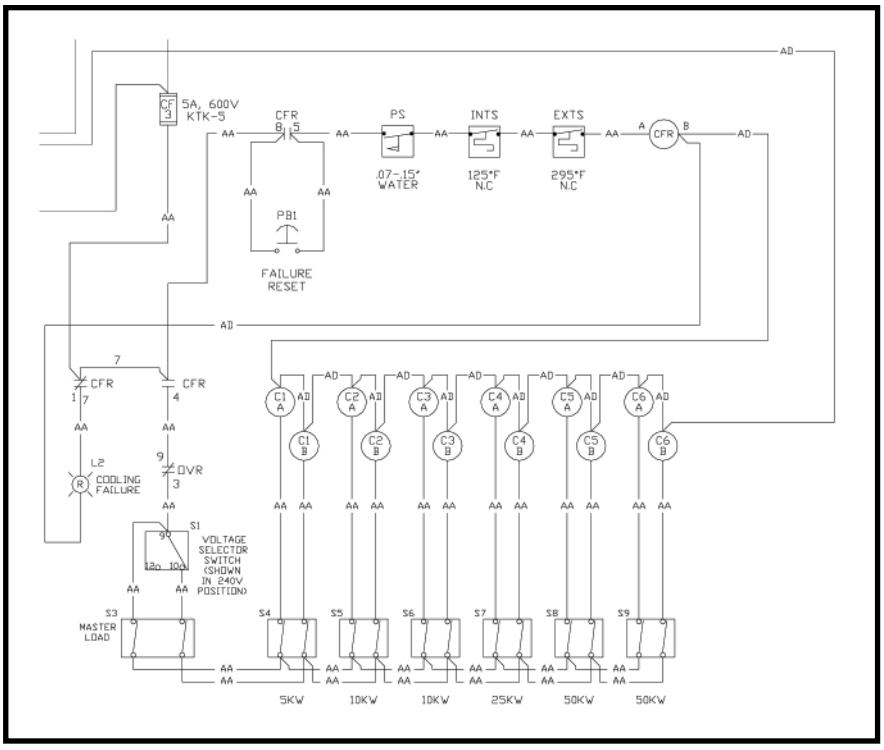
    When the "Cooling Failure" lamp extinguishes, control power is supplied to the "Master Load" switch.
12. Select the desired load steps by placing them in the "On" position.
13. Place the "Master Load" switch in the "On" position.

    This simultaneously applies all of the load steps which are in the "On" position.

    Trim is achieved by flipping the load steps "On" and "Off" while the "Master Load" is in the "On" position.
14. Adjust source voltage and load. Monitor as needed.

SHUTDOWN

1. De-energize the load.
2. Run the cooling fan for 5 minutes to assure a thorough cool down of all load elements (optional).
3. Place the “Control Power” circuit breaker (FCB) in the “Off” position.



Part of Typical Control Section Drawing

COOLING FAILURE SUBSYSTEM

Excessive intake or exhaust temperatures or any reduction in cooling air flow for any reason is indicated by the illumination of the “Cooling Failure” lamp. All load steps are locked out until the problem is corrected and failure related relays are reset. The Cooling Failure Subsystem consists of the Alarm Reset pushbutton (PB1), Fan Pressure Switch (PS), the Intake Temperature Switch (INTS), the Exhaust Temperature Switch (EXTS), and the Cooling Failure Relay (CFR). The CFR must be energized to enable load application. When the cooling fan creates sufficient airflow the PS closes. The operator presses the PB1 to complete the circuit to the CFR. CFR energizes, closing contacts 8–5, opening contacts 7–1, and closing contacts 7–4. Closed CFR contacts 8–5 lock in the circuit to the CFR, open CFR contacts 7–1 extinguishes the Cooling Failure lamp (L2), and closed CFR contacts 7–4 complete the circuit to the Master Load switch (S2).

An exhaust temperature above 295° F, intake temperature above 125° F, or a substantial reduction in air flow pressure will result in the Load Bank entering a failure state. The “Cooling Failure” lamp is illuminates and the load is de-energized. Until the failure is investigated and the control system is reset the load cannot be reapplied.

⚠ WARNING ⚠

If a failure occurs during Load Bank operation, the Load Bank will de-energize all load steps. The operator must reset the Load Bank by turning it “Off” then “On”. The load failure must be investigated and corrected before load application can resume.

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

LOAD OVER VOLTAGE DETECTION SUBSYSTEM

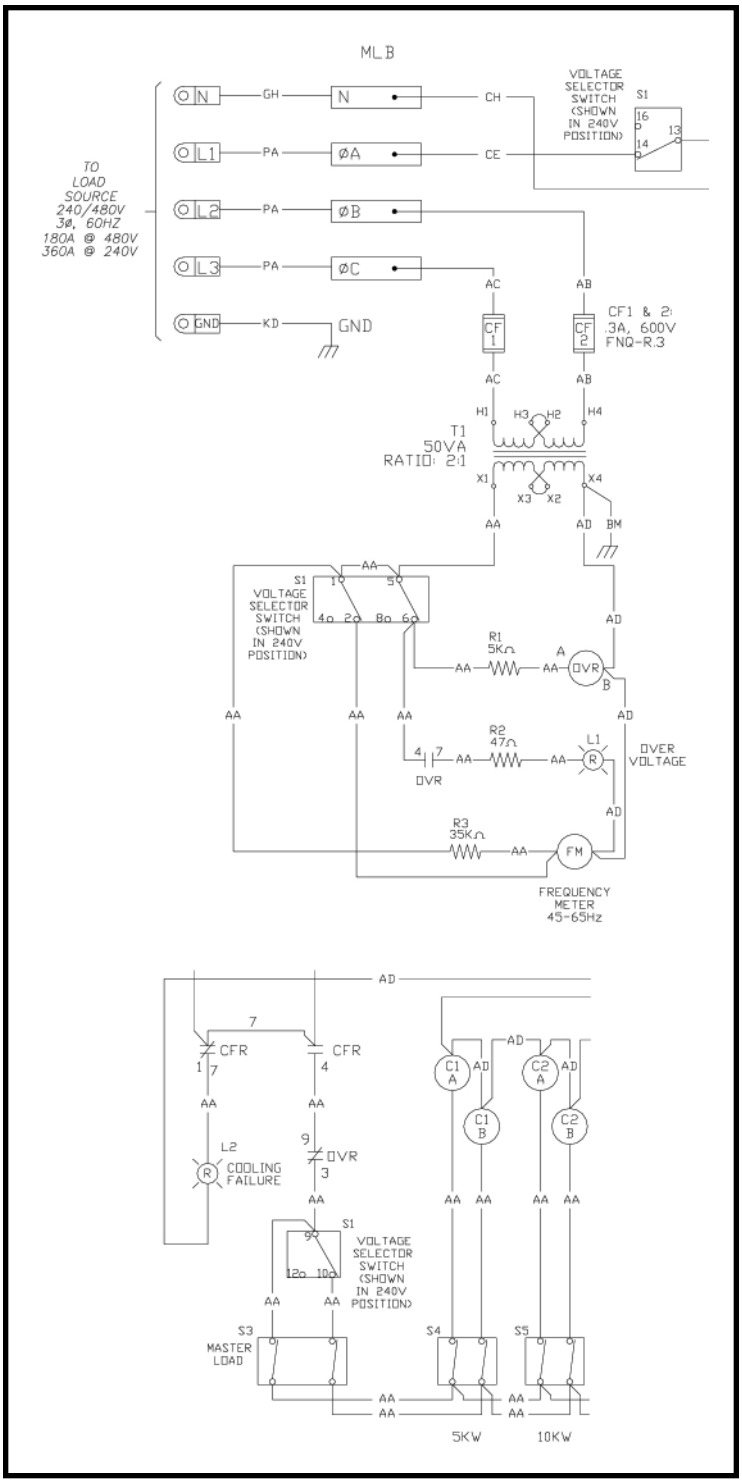
The over voltage detection network is activated only when a high (greater than 380V) voltage test source is applied and the "Voltage Selector" switch (S1) is incorrectly placed in the "Low Voltage" position. When the switch is in the "Low Voltage" position load bus voltage is supplied to the Over Voltage Relay (OVR) via Transformer T1. When load voltage becomes great enough the Over Voltage Relay (OVR) energizes. OVR contacts 4–7 close and illuminate the "Over Voltage" lamp. OVR contacts 9–3 open and interrupt the circuit to the Master Load switch (S2). The load cannot be re-applied until the control power system is reset and the load voltage selector switch is placed in the high voltage position.

LOAD ELEMENTS

The Merlin Load Bank utilizes specially designed, "Powr-Web" resistive elements. The elements are rigidly supported by high-temperature, ceramic-clad, stainless-steel rods. Element-to-element short circuits are virtually eliminated. The load elements are protected by 200KAIC, 600VAC fuses.

⚠ WARNING ⚠

Do Not allow the Load Bank to operate unattended for extended periods.



Part of Typical Control Section Drawing

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

MAINTENANCE

The Load Bank has been designed to require minimum maintenance. All components have been chosen for a long, reliable life. Two basic intervals of maintenance are required: each operation and every 50 hours or 6 months (whichever comes first).

EACH OPERATION

The air intake screens and louvers, fan and cooling chamber, and exhaust openings must be checked for any obstructions or foreign objects. Due to the high volume of air circulated, paper and other items can be drawn into the air intakes. During Load Bank operation insure that air is exiting from the exhaust vent.

The load branches should be checked for blown fuses or opened load resistors. To check the fuses or load resistors, operate the Load Bank from a balanced 3-phase source and check the three line currents. The three current readings should be essentially the same. If a sizeable difference is noted one or more load fuses or load resistors may have malfunctioned.

EVERY 50 HOURS OR 6 MONTHS

Check the tightness of the electrical connections. The expansion and contraction caused by Load Bank operation may result in loose connections. The vibrations caused by the cooling fan may also loosen electrical connections. If the Load Bank is transported “over the road”, the electrical connections should be checked for tightness at a shorter-than-normal time interval. See “Primary Inspection”.

⚠ WARNING ⚠

For continued safety and for maximum equipment protection, always replace fuses with one of equal rating only.

⚠ WARNING ⚠

Always remove all power from the load bus and all fan/control power before servicing the Load Bank. Never operate or service a Load Bank that is not properly connected to an earthground.

TROUBLESHOOTING

This section is designed to aid the electrical technician in basic Load Bank system troubleshooting. All of the problems listed can be verified with a basic test meter and/or continuity tester. For safety reasons, when troubleshooting a Load Bank systems always remove all test source power, fan/control power, anti-condensation heater power, etc.

COOLING FAN MOTOR WILL NOT OPERATE

1. Inoperative Fan Circuit Breaker (FCB)
2. Fan/Control Power not available/ incorrect
3. Inoperative Fan Motor (MOT)
4. Fan Motor Contactor (FMC) de-energized
5. Restriction of air (intake or exhaust)
6. Fan pressure switch inoperative

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

LOAD OVER VOLTAGE INDICATED

1. Load Voltage Selector switch incorrectly positioned

COOLING FAILURE INDICATED

1. Restriction of air (intake or exhaust)
2. Fan pressure switch inoperative
3. Overtemperature sensor failure
4. Alarm Reset pushbutton not engaged

TEST METERS DO NOT OPERATE PROPERLY

1. Meter voltage switch failure
2. Meter multiplier resistor inoperative
3. Improper positioning of meter voltage selector switch
4. Current transformer or current transformer wiring failure
5. Test meter failure

SOME LOAD STEPS CANNOT BE ENERGIZED

1. Inoperative load step switches
2. Inoperative load step contactors

DRAWINGS AND PARTS LIST

The drawings included in this manual are the most accurate source of part numbers for your Load Bank. When ordering replacement parts for Simplex Load Banks, always consult the Parts Legend Drawing. When contacting the Simplex Service Department always have your work order and drawing number ready for reference. The Load Bank Specifications Sheet in the front of this manual lists all of the drawings included in this manual. The Work Order Number and the Drawing Numbers are also located on each drawing legend. *A typical drawing legend and parts list is illustrated below.*

SIMPLEX™ SPRINGFIELD, ILLINOIS

SCALE :	APPROVED BY :	DRAWN BY : RER
DATE : 12/17/10		REVISED :

MERLIN 200KW
RESISTIVE LOAD BANK — CONTROL SECTION

STANDARD — DRAWING NUMBER 217598A

ITEM	QTY.	PART #	DESIG.	DESCRIPTION
1	6	24299170	LR1-LR6	LOAD RESISTORS 833W @ 240V HELICAL COIL
2	12	24299260	LR7-LR18	LOAD RESISTORS 1667W @ 240V POWR-WEB
3	6	24299510	LR19-LR24	LOAD RESISTORS 4167W @ 240V POWR-WEB
4	60	24299515	LR25-LR84	LOAD RESISTORS 4167W @ 120V POWR-WEB
5	8	13011040	C1A-C4A C1B-C4B	CONTACTOR 40A, 600V, 3POLE 120VAC COIL
6	10	13011065	C5A-C9A C5B-C9B	CONTACTOR 65A, 600V, 3POLE 120VAC COIL
7	2	13906500	CF1, CF2	FUSE, TIME DELAY 0.5A, 600V, 200KAIC

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

APPENDIX A - ABBREVIATIONS USED IN THIS MANUAL

Listed below are abbreviations of terms found on Simplex Load Bank Systems. When following a load bank drawing utilize this guide to define abbreviated system and component names. As this is a master list, drawings and text pertaining to your equipment may not contain all these terms.

AC-Alternating current

AIC-Ampere interrupting current-maximum short circuit fault current a component can safely interrupt

AM-Ammeter

AMSW- Ammeter selector switch-selects any phase for current reading

CF-Control fuse

CFM-Cubic feet per minute-used to rate fan air flow capacity and load bank cooling requirement

CFR-Cooling failure relay-normally energized relay in cooling failure subsystem

CPC-Control power contactor

CPF-Control power fuse

CT-Current transformer- used in metering circuits

DC-Direct current

EXTS-Exhaust air temperature switch

FCB-Fan circuit breaker-circuit breaker in series with fan control power

FCVR-Fan control voltage relay-normally energized relay on relay sub-panel

FM-Frequency meter-monitors frequency of test source

FMC-Fan motor contactor-controls power to fan motor

FMSW-Frequency meter switch

FPS-Fan power switch-used to energize cooling system

GFB-Ground fault breaker

GBTR-Ground breaker tripped relay

HMI-Operator Interface

HVR-High voltage relay

Hz-Hertz-cycles per second, measurement of frequency

IFCV-Incorrect fan/control voltage

INTS-Intake air temperature switch

K-Relay coil/contact designation

KVA-Kilovolt amperes

KVAR-Kilovolt amperes-reactive

KW-Kilowatts

KWM-Kilowatt meter

KWT-Kilowatt meter transducer

LM-Louver motor

LMC-Louver motor contactor

LR-Load resistive element

LX-Load reactive element

L1-Line 1

L2-Line 2

L3-Line 3

MCB-Main circuit breaker

MDS-Main Disconnect Switch

MF-Meter fuse

MLB-Main Load Bus

MOT-Motor

NEMA-National electrical manufacturer's association

ODP-Open, drip-proof-refers to motor enclosure

OVR-Overvoltage relay-relay used in overvoltage failure system, located on relay sub-panel

OLR-Overload relay-used for motor protection

OTR-Overtemperature relay-used in failure system

PF-Power factor-in resistive only loads expressed as unity (1.0), in inductive loads expressed as lagging, in capacitive loads expressed as leading

PAR-Control power available relay-relay energized when control power is available

PFM-Power factor meter

PS-Pressure switch-switch used to detect fan failure

RR-Reset relay

RTM-Running time meter-keeps time log of equipment use.

TB-Terminal block

TDR-Time delay relay-relay which times out before contacts change state

TEFC-Totally enclosed, fan cooled-refers to motor enclosure

TEAO-Totally enclosed, air-over-refers to motor enclosure

UPS-Uninterruptable power source

V-Voltage

VSR-Voltage sensing relay

XCB-Reactive load controlling circuit breaker

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

APPENDIX B - CALCULATIONS & FORMULAS

The following calculations are used to determine the actual kilowatt load being applied by the Load Bank, when line voltages and currents are known (at 1.0 power factor).

3 Phase

1. Read all three line currents and find the average reading.
2. Read all three line-to-line voltages and find the average reading.
3. Multiply the average current times the average voltage.
4. Multiply the answer of step #3 times the square root of 3 (1.732).
5. Divide the answer of step #4 by 1000. The answer is the actual kilowatts of load being applied by the Load Bank.

Single Phase

1. Determine the line current.
2. Determine the line-to-line voltage.
3. Multiply the line current times the line-to-line voltage.
4. Divide the answer of step #3 by 1000.
5. The answer of step #4 is the actual kilowatts being applied by the load bank.

EXAMPLES

Using line voltages and currents:

3 Phase

Current Readings	Voltage Readings
A_1 = 249A	V_{1-2} = 481V
A_2 = 250A	V_{2-3} = 479V
A_3 = 254A	V_{3-1} = 483V

$$\text{Average Current} = \frac{A_1 + A_2 + A_3}{3} = \frac{249+250+254}{3} = 251\text{A}$$

$$\text{Average Voltage} = \frac{V_{1-2} + V_{2-3} + V_{3-1}}{3} = \frac{481 + 479 + 483}{3} = 481\text{V}$$

$$\text{Kilowatts} = \frac{\text{Volts x Amps x 1.732}}{1000} = \frac{481 \times 251 \times 1.732}{1000} = 209.1\text{KW}$$

Single Phase

Current Reading: 150A Voltage Reading: 240V

$$\text{Kilowatts} = \frac{\text{Volts x Amps}}{1000} = \frac{150 \times 240}{1000} = 36.1\text{KW}$$

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

The following calculations are used to determine the amount of current when the desired amount of kilowatts is applied at 1.0 power factor.

3 Phase

1. Multiply the desired amount of kilowatts to be applied by 1000.
2. Multiply the operating voltage times the square root of 3 (1.732)
3. Divide the answer of step #1 by the answer of step #2.
4. The answer of step #3 is the average line current with the desired kilowatts applied at 1.0 power factor.

Single phase

1. Multiply the desired amount of kilowatts to be applied by 1000.
2. Divide the answer of step #1 by the operating voltage.
3. The answer of step #2 is the average line current with the desired amount of kilowatts applied at 1.0 power factor.

The following calculations are used to determine a step kilowatt rating at other than a rated voltage. This is accomplished by referencing the load step to a KW value at a known voltage.

1. Determine the new unrated operating voltage.
2. Divide the new operating voltage by the reference voltage.
3. Square the answer of step #2.
4. Multiply the answer of step #3 times the reference kilowatt value of the load step which the new kilowatt rating is desired.
5. The answer of step #4 is the kilowatt rating of the load step at the new voltage.

EXAMPLES

When desired amount of kilowatts is applied at 1.0 PF:

3 Phase

Applied: 50KW Operating Voltage: 480V

$$\text{Amperage} = \frac{\text{KW} \times 1000}{\text{Volts} \times 1.732}$$

$$= \frac{50 \times 1000}{480 \times 1.732}$$

$$= \frac{50{,}000}{831.36}$$

$$= 60.1$$

Single Phase

Applied: 25KW Operating Voltage: 240V

$$\text{Amperage} = \frac{\text{KW} \times 1000}{\text{Volts}}$$

$$= \frac{25 \times 1000}{240}$$

$$= \frac{25{,}000}{240}$$

$$= 104.2$$

Determining step KW at other than rated voltage:

Applied: 80KW Operating Voltage: 450V
Rated Voltage: 480V

$$\text{Step KW} = (\text{Oper. Volt.} \div \text{Rated Volt.})^2 \times \text{Applied KW}$$

$$= (450 \div 480)^2 \times 80$$

$$= .9375^2 \times 80$$

$$= 70.3$$

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

FORMULAS

		Alternating Current	Direct Current
Kilowatts	1 phase	$\frac{\text{Volts x Amps x PF*}}{1000}$	$\frac{\text{Volts x Amps}}{1000}$
	3 phase	$\frac{\text{1.732 x Volts x Amps x PF*}}{1000}$	
Amperes (KW known)	1 phase	$\frac{\text{KW x 1000}}{\text{Volts x PF}}$	$\frac{\text{KW x 1000}}{\text{Volts}}$
	3 phase	$\frac{\text{KW x 1000}}{\text{1.732 x Volts x PF}}$	
KVA	1 phase	$\frac{\text{Volts x Amps}}{1000}$	
	3 phase	$\frac{\text{1.732 x Volts x Amps}}{1000}$	
Amperes (KVA known)	1 phase	$\frac{\text{KVA x 1000}}{\text{Volts}}$	
	3 phase	$\frac{\text{KVA x 1000}}{\text{1.732 x Volts}}$	
KVAR	1 phase	$\frac{\text{Volts x Amps x } \sqrt{1-PF^2}}{1000}$	
	3 phase	$\frac{\text{1.732 x Volts x Amps x } \sqrt{1-PF^2}}{1000}$	

*Power Factor, expressed as decimal.
(Resistive Load Bank PF is 1.0)

APPENDIX C - TORQUE VALUES

FAN BLADES		
FAN PART NO.	BOLT SIZE	TORQUE FT LBS // IN LBS
13820000	SET SCREW	11.7 // 140
13820500	SET SCREW	11.7 // 140
13821000	SET SCREW	8.3 // 100
13822000	1/4 — 20	7.5 // 90
13823000	1/4 — 20	7.5 // 90
13824000	1/4 — 20	7.5 // 90
13825100	1/4 — 20	7.5 // 90
13826000	1/4 — 20	7.5 // 90
13827500	5/16”	13 // 156
13827600	5/16”	13 // 156
13828000	3/8”	24 // 288

MOTORS, BRACKETS, BUS BAR CONNECTIONS		
BOLT/NUT SIZE	GRADE	TORQUE FT LBS // IN LBS
.250 (1/4-20)	Grade 5, dry	8 // 96
.250 (1/4-20)	Grade 2, dry	5.5 // 66
.312 (5/16)	Grade 5, dry	17 // 204
.312 (5/16)	Grade 2, dry	11 // 132
.375 (3/8)	Grade 5, dry	30 // 360
.375 (3/8)	Grade 2, dry	20 // 240
.437 (7/16)	Grade 5, dry	50 // 600
.437 (7/16)	Grade 2, dry	30 // 360
.500 (1/2)	Grade 5, dry	75 // 900
.500 (1/2)	Grade 2, dry	50 // 600
.562 (9/16) & up	Grade 5, dry	110 // 1320
.562 (9/16) & up	Grade 2, dry	70 // 840

CONTACTORS
See torque values on the front of the contactor.

ELEMENTS/TRAYS		
TERM/NUT SIZE		TORQUE INCH LBS
#6	Rod ends	4
#10	Element Conn.	20
1/4-20	High Voltage	Contact Simplex

MAIN LOAD BLOCKS- ALL SIZES		
CONNECTION	WIRE SIZE	TORQUE FT LBS // IN LBS
LOAD SIDE	4-14AWG	2.9 // 35
LINE SIDE	500MCM-4/0	31 // 375
	3/0-4/0	20 // 240
	2/0-6AWG	10 // 120
	8AWG	3.3 // 40

CIRCUIT BREAKERS		
STYLE	WIRE SIZE	TORQUE INCH LBS
Cutler-Hammer 1-Phase	14-10 AWG	20
	8 AWG	25
	6-4 AWG	27
	3-1/0 AWG	45
Merlin Gerin 3-Phase	14-1/0	50

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com

APPENDIX C - TORQUE VALUES CONT'D

FUSEBLOCKS		
MANUF. PART NO.	WIRE SIZE	TORQUE INCH LBS
BM6031SQ, BM6032SQ, BM6033SQ; 600V, 30A	10-18 AWG	20
T60060-2SR 600V, 60A	10-18 AWG	20
T60030-3CR, 600V, 30A T60060-3CR, 600V, 60A 60100-3CR, 600V, 100A	10-14 AWG	35
	8 AWG	40
	4-6 AWG	45
	2-3 AWG	50

MISCELLANEOUS-TERMINALS, METERS, SWITCHES, COILS, RELAYS, XFORMERS	
CONNECTION SIZE	TORQUE INCH LBS
4	5
6	10
8	19
10	31
1/4-20"	66

TAPER-LOCK BUSHINGS	
BUSHING NUMBER	TORQUE
1008, 1108	55 IN LBS
1210, 1215, 1310, 1610, 1615	15 FT LBS
2012	23 FT LBS
2517, 2525	36 FT LBS
3020, 3030	67 FT LBS
3535	83 FT LBS
4040	142 FT LBS
4545	204 FT LBS
5050	258 FT LBS
6050, 7060, 8065	652 FT LBS
10085, 12010	1142 FT LBS

CAM-LOK STUDS	
THREADED STUD	MAXIMUM TORQUE
5/16" – 18	15 FT LBS
1/2" – 13	40 FT LBS

Merlin-150-300c.indd • © 2011 Simplex, Inc. All Rights Reserved. • Printed in the USA. • www.simplexdirect.com